two cases of recent occurrence. The fifth comet of 1877 was detected by Tempel on October 2, when its south declination was already 10°, and its motion towards the south did not permit of its being followed after October 14, when the last observations were made at Leipsic and Milan. On the orbit being calculated, it was found that the comet had passed the perihelion as early as the end of June, and, further, that it had escaped observation before perihelion, when in a much more favourable position than at the time of its discovery by Tempel. Thus, on April 5, as the moon was drawing away from the evening sky, it was in R.A. 161°, Decl. + 57°, consequently a circumpolar object in these latitudes, its distance from the sun was 1·69, and from the earth 1·05, and the intensity of light, expressed in the usual manner, was 0·32. At its actual discovery, on October 2, the distance from the sun was 1·86, and from the earth 0·88, consequently the intensity of light was 0·36, or virtually the same as on April 5. But the orbital arc available for the final calculation of the elements was less than 4½°, whereas if the comet had been detected in its more favourable position towards the end of the first week in April, there would have been available for this purpose an orbital arc of upwards of 160°.

As a second case in point, we may mention the circumstances attending the discovery of the comet by Mr. Denning last October, and its previous track. Mr. Denning found it on October 3, the perihelion passage having taken place on September 13, so that it was already at a considerable angular distance from perihelion at the first accurate observation. But prior to arriving at its least distance it had made the following tour of the southern heavens. In the column headed "Intensity of Light," the brightness at discovery on October 3 is taken as unity.

12h. G.M.T.	R.A.	Decl. °	Distance from Earth.	Intensity of Light.
June 26	296·1	− 33·8	0·481	0·8
July 25	280·3	66·9	0·159	11·9
30	228·5	80·5	0·128	20·4
Aug. 2	158·9	74·9	0·118	25·6
4	143·2	65·6	0·116	27·6
6	136·0	55·6	0·119	27·9
8	131·8	− 45·8	0·125	26·5
Sept. 13	129·2	+ 11·1	0·503	2·9

With anything approaching to a regular examination of the southern sky such an object could not have escaped notice.

CHEMICAL NOTES

WHETHER the atomic weight of uranium is represented by the number 120 or 240, is still a disputed question. Experiments recently conducted by Herr Zimmermann (*Berichte*) are strongly in favour of the latter number. Herr Zimmermann has determined the densities of the vapours of uranium tetrabromide and tetrachloride, by Victor Meyer's method, at the temperature of a Perrot's furnace; his results are as follows:—

	Sp. gr. of vapour.	Calculated.	
		U=120.	U=240.
Uranium tetrabromide	19·46 (mean of 6)	9·68	19·36
Uranium tetrachloride	13·33 (mean of 4)	6·60	13·21

SEVERAL important papers on general considerations regarding processes of chemical change, by MM. Potilitzin, Beketow, and Kajander, have appeared in the *Journal* of the Russian Chemical Society (good abstracts in *Berliner Berichte*, xiv. 2044–2058). As a deduction from experimental results, M. Potilitzin concludes that in every reaction, whether in presence or absence of water, a division of the elements of the reacting bodies occurs, and this is conditioned by the atomic weights of the elements, and the mass of the reacting substances. Berthelot's principle of maximum work is only applicable when but a single product is formed in a reaction, and when the energy, liberated in the reaction, all appears as heat. But in actually-occurring processes of chemical change there is a conversion of potential into kinetic energy, and subsequent employment of this kinetic energy in the work of fusion, evaporation, affinity, &c. Sometimes a portion of this energy may be used in the formation of compounds wherein heat is absorbed. This change of potential into kinetic energy is counterbalanced by the conversion of energy of motion into heat: a condition of equilibrium for the entire chemical system is thus attained, conditioned chiefly by the atomic weights of the reacting elements, the masses of the chemical substances in the system, and the relative amounts of potential and kinetic energy. The heat evolved in a chemical change measures the initial velocity of that change; but the final result of the change is dependent on the attainment of a general equilibrium, the conditions of which have been stated. Any change in one or more of these conditions causes a change in the direction of the chemical reaction.

IN the paper of M. Kajander the action of acids on plates of magnesium is considered: it is shown that the velocity of the action is inversely proportional to the internal friction of the liquid: raising the temperature of the liquid acts by diminishing the internal friction.

PROF. MENSCHUTKIN continues to publish, in the *Journal* of the Russian Chemical and Physical Society his researches on the influence of isomerism on the formation of compound ethers, and deals with the etherification of polybasic acids. The researches are rendered difficult by the circumstance that we know but few polybasic acids, the structure of which is well determined. Altogether the etherification of polybasic acids is very like the etherification of monobasic acids; the limits of etherification are always high, if a primary alcohol is taken for the formation of the ether; the rate of etherification varies with the isomerism of the acid, and the variations of the rate are as in monobasic acids. This likeness is the more remarkable, as the reactions are far more complicated in this case than in the preceding one.

PROF. MENSCHUTKIN also discusses the influence of the molecular weight of homologues on the course followed by incomplete and reversed reactions. He has succeeded in establishing that the law of homology, extends as well to the chemical as to the physical properties of homologues, and as well to their complete reactions, as to the incomplete ones.

THE phenomenon noticed by Mills, and called by him "chemical repulsion"—referred to some time ago in these "Notes"—has been recently studied by Herr Lecher (*Wien. Akad. Ber.*), who thinks that there is no need for the new hypothesis of chemical action at a distance introduced by Mills. A few drops of barium chloride solution are placed on the surface of a glass plate, a second plate containing two circular holes is pressed on the first, and a drop of sulphuric acid is introduced at each hole: the formation of barium sulphate proceeds in circles which gradually extend their circumference, but cease to do so before they come into contact. The author's explanation, which is based on several experiments, assumes that the barium chloride molecules originally move equally in all directions through the liquid; the presence of sulphuric acid, however, fixes many of these molecules and prevents their moving out of the sphere of action of the acid: the space between the advancing circles of barium sulphate thus becomes gradually poorer in barium chloride, until finally the whole of this salt is removed: there is a space of no action, because the compounds which react are absent.

HERR SCHULZE (*Journ. für pract. Chem.*) describes an interesting case of so-called "catalytic action." Sulphuryl chloride (SO_2Cl_2) is not formed by the action of chlorine on gaseous or liquid sulphur dioxide, but if these gases be passed over camphor, large quantities of sulphuryl chloride are produced; five grams of camphor sufficed to induce the formation of 470 grams of sulphuryl chloride. Acetic or formic acid likewise induces the combination of chlorine and sulphur dioxide, but these compounds are themselves more or less attacked, whilst camphor remains unchanged at the close of the reaction. Acetic and formic acids dissolve considerable quantities of sulphur dioxide, but other good solvents of this compound, *e.g.* acetone, fail to induce the formation of sulphuryl chloride.

MALLET (*Amer. Chem. Journ.*) finds the number 1·759 as representing the sp. gr. of hydrofluoric acid gas at 25°, hence molecular weight = 39·32. If this determination is confirmed, the formula of the compound in question must be written H_2F_2, and not, as at present, HF. But if Mallet's formula is correct, the atom of fluorine must be divalent; it has hitherto been regarded as markedly monovalent.

M. L. DE BOISBAUDRAN (*Compt. rend.*) has prepared gallic chloride, Ga_2Cl_6. The specific gravity of the vapour of this chloride, at 273°, was found to be 11·9, which confirms the formula Ga_2Cl_6.

AN iron wire embedded in lampblack and heated to redness in the reducing flame of the blowpipe loses weight; a portion of the iron, according to Colson, diffuses into the carbon. This chemist states that solids diffuse into each other when a chemical

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action can take place between the solids in contact (*Compt. rend.* xciii. 1074).

IN the *Berichte* (xv. 109) Brauner describes some new compounds of the cerium metals, especially *Cerium tetrafluoride*, CeF_4, and didymium pentoxide, Di_2O_5; he also gives data whence he deduces the value 146·5 for the atomic weight of didymium. Brauner likewise discusses the grouping of these metals in accordance with the "periodic law," and shows that didymium may fairly be placed as the eighth member of group V., the members of which group form pentoxides, M_2O_5 (see also *Chem. Soc. Journal*, Trans. 1882, p. 68).

VARIOUS new salts analogous to the ferrocyanides and ferricyanides are described by Descamps (*Ann. Chim. Phys.* [5] xxiv. 178), chiefly *mangano-* and *mangani-cyanides*, *cobalto-cyanides*, and *chromo-cyanides*.

FROM experiments on the action of sulphur dioxide on nitric oxide, Lunge concludes that, when water is present, sulphur dioxide partially reduces the higher oxides of nitrogen to nitrous oxide, even in presence of free oxygen (*Berichte*, xiv. 2196). These results of Lunge's have a direct bearing on the changes which proceed in the chambers of the sulphuric acid manufacturer.

THE synthetical production of urea, by passing air charged with ammonia and benzene over hot spirals of platinum wire, is described by E. F. Herroun in *Chem. Soc. Journ.* Heated spongy platinum, or platinised asbestos, caused a large production of ammonium carbonate with little urea; platinised charcoal caused the production of much urea, but the action proceeded more slowly than when spirals of platinum wire were employed.

FROM results of series of measurements, the following general statement regarding fractional distillation is made by F. D. Brown (*Chem. Soc. Journ.*). "In distillations with a still-head maintained at a constant temperature, the composition of the distillate is constant, and is identical with that of the vapour evolved by a mixture whose boiling-point equals the temperature of the still-head." Brown thinks that the reciprocity between a liquid mixture and the gaseous mixture evolved by it on ebullition has been too much neglected in reasonings about fractional distillation.

THE explosion of fulminate of mercury has been studied by Berthelot and Vieille (*Ann. Chim. Phys.*). The chemical change which occurs when this salt is exploded is a simple one, thus: $C_2HgN_2O_2 = 2CO + N_2 + Hg$; the heat produced, at constant pressure, per gram-molecule, is sufficient to raise the temperature of the products of explosion (supposing these already gaseous) to about 4200°. The local action exerted when the fulminate is exploded in a closed vessel is more violent than with other explosives, but the total pressure is only about three-fourths of that produced by dynamite or nitro-glycerine. The instantaneous nature of the explosion of fulminate, the almost complete absence of dissociation of the products, and the high specific gravity of the material, conspire to render the explosion of this substance very effective.

ACCORDING to M. Amagat (*Compt. rend.*) pure dry oxygen exerts no action on mercury even under pressure: this is opposed to the results obtained by Regnault.

FURTHER observations bearing on the relations existing between molecular structure and the absorption spectra of carbon compounds are described by Hartley (*Chem. Soc. Journ.*, Trans., p. 45), who concludes that "the simple union of carbon to nitrogen does not cause selective absorption of the ultra-violet rays." This conclusion is aplied to a discussion of the structural formulæ of several compounds, more especially of *cyanuric acid*, the molecule of which appears to possess "a nucleus with a compactness of structure intermediate between that of benzene hexchloride and that of benzene."

EXPERIMENTS by Remsen and Hall (*Amer. Chem. Journ.* ii. 50) on the oxidation of *sulphamine-para-toluic acid* confirm the general statement that when, in a derivative of an aromatic hydrocarbon, one of the substituting groups is electronegative, this negative group exerts a *protective influence* on the other group during oxidation.

VARIOUS papers on the cinchona alkaloids have recently been published: two new alkaloids are described, one by Arnaud, under the name of *cinchonamine* (*Compt. rend.* xciii. 593), the other—*homoquinine*—by Howard and Hodgkin (*Chem. Soc. Journ.*, Trans., 1882, p. 66). Both alkaloids are found in bark from Santander, Columbia, described by Flückiger as *China cuprea*. The structural formulæ of *quinoline*, *quinic*, and *quinuric acids*, are discussed at length by Skraup (*Monatshefte für Chemie*, ii. 587). Various sulphuric derivatives of cinchonine are described by Weidel (same journal, p. 565), and papers of importance, although too technical for detailed notice here, on cinchonine and the so-called homocinchonine, by Koenigs, Hesse, and Claus, appear in the *Berichte* (xiv. 1852, 1888, 1890, and 1921).

REINCKE states (*Berichte*, xiv. 2144) that he has obtained aldehydic substances from the juices of chlorophyll containing plants. The formation of these substances appears to depend on the action of sunlight. Reincke thinks that formic aldehyde is present as the most active among these reducing substances, but he does not support this supposition by experimental evidence.

HERREN GOLDSCHMIDT and V. Meyer describe a modification of the well-known apparatus of the latter chemist for determining the specific gravities of gases. The apparatus is filled with dry air, and heated to the temperature at which the determination is to be made; the air is then driven out by a stream of hydrochloric acid, received in a graduated tube standing over water, and measured: the gas under examination is passed into the apparatus, heated, and driven out by dry air into weighed potash-bulbs containing a liquid which will absorb the gas. In this way the weight of the gas is obtained; the volume of air gives the volume of this weight of gas at the observed temperature. The apparatus may also be used as an air-thermometer (*Berichte*, xv. 137).

NOTES FROM THE OTAGO UNIVERSITY MUSEUM

II.—*On the Skeleton of Notornis Mantelli*[1]

HITHERTO the rare flightless rail, *Notornis Mantelli*—the Takahe of the Maoris—has been known only by the two skins now in the British Museum, and by a few fossil bones, found associated with remains of *Dinornis*, *Aptornis*, &c.

Quite recently a third specimen was killed on the eastern shores of Lake Te Anau, and the finder, Mr. J. Connor, not only removed and preserved the skin, but, most fortunately, retained as well the roughly-cleaned skeleton of the trunk. With Mr. Connor's permission, I have prepared a description and drawings of the more important parts of this unique specimen, which is now, with the skin, on its way to England for sale.[2]

The skeleton, consisting as it does, of the parts saved after skinning, is *minus* the skull and anterior cervical vertebræ, the wing-bones, the bones of the legs with the exception of the femora, and the posterior caudal vertebræ. It is in very good preservation, with the exception of the ribs and the femur on the right side, which are shattered, probably by shot, and the right side of the middle xiphoid process of the sternum, which is slightly cut, apparently during skinning.

The more important measurements are as follows:—

	cm.
Length of trunk, measured from the anterior (dorsal) ends of the coracoids to the posterior end of the pelvis ...	18·5
Length of scapula	8·0
,, coracoid	4·2
,, sternum	6·8
Width of sternum, measured just posterior to the coracoid grooves	4·3
Depth of carina sterni	0·9
Length of ilium	10·4
Width of pelvis at posterior border of acetabula	5·6
Length of femur	10·3

In the vertebral column the nine posterior cervical vertebræ are

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[1] Abstract of a paper read before the Otago Institute on September 21, and to be published in the next (13th) volume of the *Transactions* of the New Zealand Institute.

[2] It was much to be regretted that the funds of this Museum did not allow of the purchase of these specimens and their retention in New Zealand. But by the kindness of two ladies, Miss F. M. Wimperis and Miss Maud McLaren, the Museum now possesses the next best thing to the actual specimen, namely, two life-sized oil paintings, executed with a fidelity and artistic skill which leave nothing to be desired. I was the more glad to obtain these pictures, as the Te Anau specimen differs in many details of colouring from the British Museum examples, notably in the absence of the broad black band on the neck and of the crescentic markings on the wing-coverts.

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